A STUDY OF READING DIFFICULTIES IN TORONTO SCHOOL CHILDREN

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PRIMARY dyslexia means a difficulty in learning to recognize the written symbols of language. It could be considered a sensory aphasia affecting the association areas of the visual cortex. The term "primary" rules out reading difficulties based on known factors including deafness, defective vision, low intelligence, emotional disturbance, poor teaching, absenteeism and cerebral damage. If a child in grade 1 to 3 is reading at least one year behind the level of his intellectual ability, he may be said to have dyslexia.

The purpose of this paper is to present the findings of a study on a group of dyslexic Toronto school children. An attempt has been made to assign proper significance to any ocular errors noted in these children. As a control a second group of children of comparable age with large heterophorias at the reading point was investigated, bearing in mind that heterophorias have been associated with reading difficulties.[1-3]

In Toronto schools two reading consultants see all children who are considered by their teachers to be retarded readers. The child's specific reading problems are determined. A careful study of the general health, intelligence, emotional problems and home situation is made in an attempt to elicit secondary factors. The child is then referred to appropriate consultants for further examination.

METHOD

Twenty-two of these dyslexic children were referred for ocular examination at the Toronto Western Hospital. With the help of the orthoptist an ocular examination and orthoptic assessment of each child were carried out.

FINDINGS

These children were all boys. This is consistent with the recorded literature which indicates that 80% to 90% of dyslexic children are boys. The ages were from 8 to 12 years in this series under study. Each was retarded by at least one year in his reading progress, most by two or three years. One child with superior intelligence was retarded five years relative to his intellectual development. The intelligence quotient of these children varied from 90 to 127 on the Otis or Binet-Stanford scales.

Four of the children were obviously emotionally disturbed. Their mothers had been unable to comprehend the nature of their reading problem and were adding to the emotional strain by putting pressure on the children. When protected from these pressures by understanding parents and by special teaching, dyslexic children usually develop much more satisfactorily than could be anticipated from their early failures. By the time the child is seen by the psychologist, however, it is frequently impossible to differentiate primary from secondary emotional problems.[1]

TABLE I.—VISUAL ACUITY AND REFRACTIVE ERRORS IN 22 CASES OF DYSLEXIA

Visual acuity	*Number*
Normal (20/25)	14
Subnormal (both eyes)	6
Subnormal (one eye)	2
Refractive errors	
Emmetropia (error not exceeding —0.50 + 1.50 dioptre)	15
Myopia (over —0.50 dioptre)	1
Hyperopia (over +1.50 dioptre)	2
Astigmatism (over 0.50 dioptre cylinder)	4
High astigmatism (over 2.00 dioptre cylinder)	0

Table I lists the visual acuity and refractive errors of the group. Uncorrected visual acuity was 20/25 or better in both eyes in 14 children. The refractive errors were all of minor degree. Fifteen children were emmetropic, one was myopic, two were hyperopic and four had low degrees of astigmatism, below 2 dioptres. Three were wearing glasses, and spectacles were prescribed for a fourth. The improvement in vision from 20/30 to 20/20, effected with +1.25 dioptre cylinders, had little effect on the reading problem of this child. He was emotionally disturbed both from stress at home and through school failure. The wearing of glasses undoubtedly aggravated his emotional distress. After consultation with both mother and reading teacher, it was advised that the glasses be discarded.

TABLE II.—HETEROPHORIAS IN 22 CASES OF DYSLEXIA

	Number
Orthophoria	14
Exophoria—for near only	2
—for distance only	1
—for both near and distance	1
Esophoria—for near only	0
—for distance only	0
—for both near and distance	2
Mixed esophoria and exophoria	2

The extraocular muscle balance was measured by cover test, Maddox rod, Maddox wing and synoptophore assessment. Table II lists the abnormalities of muscle balance. The heterophorias were mostly minor. Orthophoria was considered to be present if lateral deviations were consistently less than 4 prism dioptres and vertical deviations less than 2 prism dioptres. Fourteen of the 22 children were orthophoric; three had exophoria for near (i.e. measured at 33 cm. distance) of 4 to 6 prism dioptres; and two had esophoria for near of 4 to 6 prism dioptres. No large heterophorias were present and no significant hyperphorias were

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noted. Most of these heterophorias were variable from one measurement to the next.

All of the children tested showed full stereopsis with some amplitude of fusion on the synoptophore and all were normal with the American Optical stereoscopic fly. All had full convergence facility, to 6 cm.

Measurement of ductions was carried out with the synoptophore. The standards of Lyle and Bridgeman were used.[10] The amplitudes of fusion found in the group are listed in Table III. Plus 25 prism dioptres of convergence and minus 6 prism dioptres of divergence were considered minimal normal amplitude. Weakness of convergence was noted in five children, two of these showing weakness of divergence as well. Most of the remaining children showed a high amplitude of fusion, exceeding plus 50 prism dioptres and minus 10 dioptres.

TABLE III.—FUSIONAL AMPLITUDES IN 22 CASES OF DYSLEXIA

	Number
Normal range	15
Convergence less than 25 dioptres	5
Divergence less than 6 dioptres	2

Note: Four cases with convergence deficiencies increased with practice to normal levels.

Electroencephalograms were performed on all of these children. A further report on the interpretation of these findings will be made.

In assessing the significance of small heterophorias in dyslexic children it was interesting to contrast their reading skills with that of a group of children with large heterophorias, measured at 15 inches. Admissions to the Hospital for Sick Children, Toronto, of children with the diagnosis of strabismus were reviewed. Children 8 to 10 years of age with heterophoria for near, admitted in 1958 to 1960, were selected for study. The children who comprised this group represented both public and private admissions and came from Toronto and surrounding localities. All had large heterophorias of 20 to 60 prism dioptres for near and had good vision in both eyes. The school records of six of these children have been obtained along with the teachers' comments regarding their ability. The assessment of reading ability was made by comparison with their grades in other subjects and with class averages.

Five of these six children were below-average readers. Most significant, reading was the only weak subject of four of the six. One very intelligent boy had an A average in all subjects except reading. He was consistently graded C in reading and was assessed as a poor reader by his teacher. Another boy living in a small town was graded poor in reading. Because of his reading problem he was made to repeat grade 4. In other subjects his marks were all A's and B's. Since he was at least one year behind in his reading progress, he was dyslexic. Three of the remaining four children showed a specific reading weakness. One was an average reader. None of these children has been seen by the reading consultant. Thus we do not know if there are any extraocular factors to account for their slow reading progress.

DISCUSSION

In comparing the reading ability of this second group of six children with that of the six dyslexic children with minimal heterophorias of 4 to 6 prism dioptres of lateral deviation, what significance may be attached to heterophoria as a cause of dyslexia? In a study carried out by Park[2] on 133 dyslexic children an incidence of 45% of small heterophorias was found. Nicholls[5] believes that heterophoria has little bearing on reading retardation. He agrees with Goldberg's statement that muscle imbalance does not affect the interpretation of symbols, but may cause fatigue and discourage reading.[4] This conclusion is borne out by the six children with heterophorias of 20 to 60 prism dioptres, four of whom were moderately poor readers and one of whom was dyslexic. They can surely be classed as secondary reading problems. The majority of the frankly dyslexic children, however, were orthophoric. Of the 22 children examined, the five children who had heterophorias of 4 to 6 prism dioptres had borderline orthophoria only.

Goldberg, Marshall and Sims[7] have reported a study of electroencephalograms in dyslexic children. They report a high incidence of electroencephalographic abnormalities, predominantly of the occipitoparietal lobes, and suggest that primary dyslexia may be the result of birth or prenatal anoxia. This may account for some of the unexplained cases of primary dyslexia.[6] However, one cannot ignore the fact that of the 1 to 2% of our school children who are dyslexic, 80% to 90% are boys, and there is a strong incidence of family history. These data are borne out by many studies.

CONCLUSION

The exact nature of so-called "primary" dyslexia is not determined. We know that there are 1000 to 2000 dyslexic children in Toronto. The reading consultants are able to assess 300 of these children every year. Thus, many do not even have the advantage of reading consultation. The oculist may have these children brought to his office in the hope that an ocular error can account for the reading failure and that the reading problem may thus be solved. While heterophorias may result in slight reading retardation, and should be dealt with when symptoms of fatigue or asthenopia are present, stress should not be placed on small ocular errors. It is important that the oculist recognize the real problem and refer the child for proper assessment. His responsibility lies in encouraging a great extension of the special educational facilities available for these children. These children can be taught to read but only in small classes, with specially trained

teachers and by utilizing all methods of learning.[8,9] Until such facilities are available, many intelligent children will continue to experience frustration and much of their talent will be lost.

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CERTAIN MANIFESTATIONS OF RESPIRATION IN PREMATURITY

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THIS study of newly born premature infants attempts to correlate the respiratory rate patterns and the signs of respiratory distress with prognosis for survival.

Infants suffering respiratory distress have been shown to have increased respiratory rates.[1,2] Miller[3-5] emphasized the significance of the trend of the respiratory rate, reporting that cases of respiratory insufficiency and deaths occurred in those whose respiratory rates increased during the first day or two of life. This was in part confirmed by studies[6,7] in which it was noted that most, but not all, of the deaths occurred in such cases. Opposed to this observation are reports[7,8] of deaths from respiratory insufficiency in infants with persistently low rates.

Bauman,[9] using a method of scoring respiratory retractions similar to that used in this study, reported that dyspneic premature infants had a case fatality rate about six times as great as that for those without distress.

METHOD

Observations were made on every infant whose birth weight was between 1000 and 2500 g., admitted to the Premature Nursery, St. Joseph's Hospital, Toronto, from August 1, 1958, to December 31, 1960. Because there was a relatively large number of heavier premature infants, those born during the last six months of this period with a birth weight between 1750 and 2500 g. were excluded.

Respiratory rates were measured for one minute at two-hour intervals for the first 48 hours of life and at four-hour intervals for the next three days. Measurements were not made when infants were crying or feeding. The initial measurement was made during the first hour of life and a very few babies were excluded because this procedure was not carried out.

The degree of respiratory distress was determined by the standards of Silverman and Andersen.[10] One or two points, according to severity, are awarded for each of five signs of respiratory distress: xiphoid retraction, intercostal retraction, retraction of upper chest, chin retraction, and expiratory grunt. The distress score may range from 0, for no distress, to 10, for very marked distress. Distress scores were determined at the same times and intervals as were respiratory rates.

Infants received oxygen only for cyanosis or respiratory distress. Concentrations were kept below 40% unless otherwise ordered by the attending physician.

Deaths occurring in the first seven days were recorded.

Statistical significance of the findings in this study was determined by means of fourfold contingency tables and the chi-square (X^2) test. A probability value (P) of less than 0.01 is considered highly significant.[11]

DEFINITIONS

Respiratory Groups

Infants were allotted to one of three respiratory groups according to the trend of the respiratory rate and approximately by the criteria of Miller and Conklin.[3] A fourth group was added to include those with persistently low rates.

Group I consists of infants whose respiration started at 30 to 50 per minute and was maintained within these limits.

Group II consists of infants whose rates within the first hour were over 50 per minute but subsequently fell to between 30 and 50 per minute.

Group III consists of infants whose rates increased significantly in the first 24 hours to reach a maximum in excess of 50 per minute. An increase in rate was considered significant if two consecutive readings showed an increase of 15 per minute over the rate recorded initially. Thus, to be in-

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